

The Use of Morphological Characteristics and Texture Analysis in the Identification of Tissue Composition in Prostatic Neoplasia

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Quantitative examination of prostate histology offers clues in the diagnostic classification of lesions and in the prediction of response to treatment and prognosis. To facilitate the collection of quantitative data, the development of machine vision systems is necessary. This study explored the use of imaging for identifying tissue abnormalities in prostate histology. Medium-power histological scenes were recorded from whole-mount radical prostatectomy sections at $\times 40$ objective magnification and assessed by a pathologist as exhibiting stroma, normal tissue (nonneoplastic epithelial component), or prostatic carcinoma (PCa). A machine vision system was developed that divided the scenes into subregions of 100×100 pixels and subjected each to image-processing techniques. Analysis of morphological characteristics allowed the identification of normal tissue. Analysis of image texture demonstrated that Haralick feature 4 was the most suitable for discriminating stroma from PCa. Using these morphological and texture measurements, it was possible to define a classification scheme for each subregion. The machine vision system is designed to integrate these classification rules and generate digital maps of tissue composition from the classification of subregions; 79.3% of subregions were correctly classified. Established classification rates have demonstrated the validity of the methodology on small scenes; a logical extension was to apply the methodology to whole slide images via scanning technology. The machine vision system is capable of classifying these images. The machine vision system developed in this project facilitates the exploration of morphological and texture characteristics in quantifying tissue composition. It also illustrates the potential of quantitative methods to provide highly discriminatory information in the automated identification of prostatic lesions using computer vision.

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